The Performance of the Cellular Industry

From its beginning, the business of supplying cellular telephone communications has been characterized by rapidly increasing volume, declining prices, expanded service offerings, and significant technological change.

The volume of cellular services can be measured either by the number of subscribers or by the minutes of airtime used. The number of cellular telephone subscribers had grown from only 91,600 in January 1985 to an estimated 8.8 million by June 1992. Growth has continued to be rapid, with the number of cellular subscribers increasing by 46 percent during the 12 months ending June 1991 and by 39 percent in the 12 months ending June 1992.[1] The number of cellular subscribers is projected to be 19 million by 1995 and 38 million by 2001.[2] Growth in cellular airtime also has been substantial, although it has been slower than the growth in the number of subscribers because later subscribers have tended to use the service less intensively than earlier adopters. This change reflects the increased importance of residential users of cellular telephones relative to business users.

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[1]Cellular Telecommunications Industry Association, Industry Data Survey, June 30, 1992, p. 1. The growth in volume that has occurred has far exceeded expectations. When commercial cellular service began in the United States in 1983, the potential demand in the year 2000 was thought to be between one and two million subscribers; see Coopers & Lybrand, Technological Change and the Cellular Telecommunications Industry (November 1991), p. 15.

[2]Linden Corporation, Cellular Network Technology, End User Requirements, and Competition to the Year 2001, 1991, p. 244.

Contributing to this increasing volume has been a steady decline in the costs of owning and using cellular telephones. For example, the nominal price for 250 minutes of prime airtime usage per month across the ten largest cellular service areas had, in 1989, declined by 19 percent from the inception of commercial cellular service in 1983. Even with a slight increase in carrier charges estimated for 1991 and 1992, the unweighted average of the lowest published rate for access and 250 minutes of usage during prime time in these ten service areas was only 85 percent of its 1983 level. When adjusted for inflation, the average of these rates in the ten largest cellular service areas in 1991 was only 62 percent of its 1983 level.[3]

The monthly cost of a mobile cellular telephone has declined by even more than carrier charges, from $79 in 1983 to $7 in 1991. During the same time, the quality of mobile telephone service was also enhanced by improvements in functions and features. When adjusted for inflation, the total cost of owning and using a cellular telephone in 1991 was only 44 percent of its cost in 1983.[4]

Cellular subscribers have benefitted not only from falling prices but also from the continually expanding variety of services offered by cellular operators. Only five years ago, there were no

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[3]Data are from Herschel Shosteck Associates, Ltd., Cellular Market Forecasts, Data Flash, September 1992.

[4]Data are from Shosteck, op. cit., and measure the "drive away" price of a single mobile telephone, including antenna, installation, and first-year maintenance.

value-added cellular services. Today, cellular providers offer a number of information services as well as features such as voice mail, call forwarding, and call waiting. There have been major advances in data transmission as well, including portable facsimile and wireless transmission for laptop computers. New services continue to be developed. For example, cellular telephones now are being used to verify credit cards and to transmit information to and from remote locations in computerized monitoring and reporting systems.

Technological advances in recent years also have enabled cellular systems to expand their capacity. Several capacity-increasing innovations have occurred in the conventional or analog cellular technology, such as adjusted power output, antenna tilting, dynamic channel assignment, and cell repeaters and umbrella (underlay/overlay).[5]

Notwithstanding the continuing improvements in analog-based cellular systems, even more dramatic advances are expected from the further development and application of digital technology. Virtually all cellular switches made today are digital, and the shift to this technology is expected to occur in base station radios and subscriber telephones during the 1990s.[6]

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[5]H. Shosteck, "The question marks over PCNs," Mobile Europe, January 1991, no pagination.

[6]Coopers & Lybrand, op. cit., pp. 59-60. During a transition period, cellular phones will be dual mode, adaptable to both digital and analog systems.

The conversion to digital technology, despite the substantial investment required, promises to yield even greater increases in system capacity and lower average costs for cellular operators. For example, the capacity of base stations will at least triple initially. In addition, digital technology will permit new services to be provided.[7]

Competition in the Supply of Cellular Services

This performance of the cellular service industry is the kind that economists associate with a young industry driven by market forces and developing in a competitive context,[8] and it has occurred without the industry's having a competitive structure, as economists define that term.[9] The FCC has determined that the cellular service business should be a structural duopoly: only two facilities-based suppliers, one wireline carrier and one nonwireline carrier, are permitted to operate in a service area, with additional facilities-based entry barred. Economists have recognized, however, that the behavior of firms and the performance of an industry can approximate the competitive outcome even if the

[7] Ibid., p. 60.

[8] While this record of performance is consistent with a competitive industry, it does not prove that the industry is necessarily competitive, since even a monopolist facing conditions of increasing demand and reduced costs is likely to earn greater profits by lowering price, expanding output, and making innovations in products and methods of production.

[9] Economists call a market structure competitive when entry is easy, firms are numerous, and no firm has a large market share. As we point out in the text, the performance of a market can be competitive even if its structure is not.

industry does not consist of a large number of firms, none of which serves a large share of the market.

Economists consider the number and size distribution of firms in a market to be important initial indicators of the likelihood of noncompetitive behavior.[10] Collusive arrangements, whether explicit or tacit, are more likely when there are only a few firms, simply because coordination is easier. Similarly, the costs of monitoring the behavior of others and enforcing any collusive arrangement by punishing "cheaters" are lower when there are few industry participants.[11] The size distribution of firms also affects the ease of coordination. A small number of very large firms may serve as coordinators in an industry that also includes many small firms.

However, economists also recognize that the competitive outcome, where prices are driven to marginal costs, may obtain even in industries with as few as two firms.[12] Theoretical models of the strategic interactions between duopolists predict a broad range of outcomes, from monopolistic to perfectly competitive.[13] In

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[10] M. Spence, "Tacit Co-ordination and Imperfect Information," Canadian Journal of Economics XI (1978), pp. 497 and 499.

[11] J.S. Bain, "Relation of Profit Rate to Industry Concentration," Quarterly Journal of Economics LXV (1951), pp. 205-206.

[12] The best-known model demonstrating this result is found in J. Bertrand, "Théorie Mathématique de la Richesse Sociale," Journal des Savants, 1883, pp. 499-508.

[13] A large body of economic literature, predicting a range of competitive outcomes, is reviewed in J. Tirole, The Theory of Industrial Organization (Cambridge, MA: The MIT Press, 1988), pp. 225-308.

these models, firms choose whether to cooperate and at which price. The outcome depends on the reaction that each firm expects from its competitor to changes in its own price or output. This, in turn, determines the gains that each firm expects from undercutting a noncompetitive price, and the expected cost of being punished if such deviation is detected. Even duopolists do not necessarily react to each other's actions in ways that maximize joint profits: a duopoly is not the same as a monopoly.

The decision rules that comprise a firm's competitive strategy are difficult to infer from its observed behavior. Nonetheless, economists have identified a number of significant factors, in addition to the number of its rivals, that influence the strategies each firm pursues, and thus help to determine how close to the competitive outcome the industry's performance will be.[14] These are factors that make collusive practices more or less difficult to establish, and affect the ease with which deviations from a collusive outcome can be detected and punished. Several of these factors are likely to influence the performance of the cellular service industry, albeit to varying degrees.

One of the most striking features of the mobile communication industry is the rapid pace of technological innovation and diffusion. Transmission technology has evolved from analog to digital, and cellular telephones have become truly portable, shrinking to pocket size. The rate of technological change and the

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[14] G. J. Stigler, "A Theory of Oligopoly," Journal of Political Economy 74 (1964), pp. 44-61.

resulting speed with which the customer base is growing are two influences that economists consider procompetitive.

The rapid technological change in the provision of cellular service imparts a high degree of variability to the services offered and the prices of those services. In these circumstances, a collusive agreement is difficult to maintain, because the price of each new service must be integrated into the existing price structure.[15] As providers adopt new technologies, the introduction of new service packages offers opportunities to "cheat" on a noncompetitive agreement without provoking the "punishment" that might otherwise occur, because it is difficult for a rival to determine what the appropriate price of the new service should be. If new services are offered at more competitive prices, because it is easier to deviate from a collusive agreement when products are changing, or even if rivals only perceive that the new services are being offered at prices that are "too low" because they do not know what those prices should be, a collusive agreement may be difficult to establish and maintain.

The rapid rate of technological innovation not only hinders the smooth functioning of a collusive pricing agreement but, by leading to rapid market growth, also may weaken the incentive for firms to participate in such agreements. When markets are growing

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[15] R.A. Posner, Antitrust Law: An Economic Perspective (Chicago, IL: The University of Chicago Press, 1976), pp. 59-60.

rapidly, demand tends to be more inelastic, so the gains from deviating from a collusive price are greater.[16]

The importance of technological innovation in the provision of cellular services may lead to low prices for a third reason. Economic models predict there may be gains to pricing aggressively in industries characterized by significant learning economies. By keeping its prices low, a firm can increase production and achieve cost savings more rapidly as it moves down its learning curve.[17] These models predict that economic performance will be better if, instead of many small firms, the industry consists of a few large, long-run profit-maximizing firms. The predictions of such models are supported by experiences in the semiconductor and related electronics industries.[18]

The history of the players' competitive behavior shapes their future behavior as well.[19] Early in the history of cellular services, when the wireline carriers already were established and the nonwireline carriers were just beginning to serve customers, the new providers had an especially strong incentive to initiate price cuts. While they would realize lower revenue from their

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[16] J.J. Rotemberg and G. Saloner, "A Supergame-Theoretic Model of Price Wars During Booms," American Economic Review 76 (1986), pp. 390-407.

[17] A.M. Spence, "The Learning Curve and Competition," The Bell Journal of Economics 12 (1981), pp. 49-70.

[18] F.M. Scherer and D. Ross, Industrial Market Structure and Economic Performance, Third Edition, (Boston, MA: Houghton Mifflin Co., 1990), pp. 373-374.

[19] Posner, op. cit., p. 61.

small bases of existing customers, this would be more than offset by revenues from the new customers they were able to attract.[20] The newer providers of long-distance telephone service faced similar incentives to price competitively against AT&T. Competition in the provision of long-distance service is considered by many to have increased significantly when start-up firms began offering service alternatives to AT&T, despite the fact that the structure of the industry is still quite concentrated.

Nor does it appear that the cellular service industry has established stable market-sharing arrangements as the nonwireline carriers' shares have grown to a substantial size. An example of shifting market shares is seen in Detroit. In that market in 1987, PacTel and Ameritech had 51.2 and 48.8 percent of the subscriber base, respectively. An industry analyst estimated that at year end in 1991, Pactel's share had fallen to 40.5 percent, and Ameritech's had risen to 59.5 percent.[21]

A final characteristic of cellular service markets that weakens industry cohesion, and thus the ability of firms to raise prices, is the heterogeneity of product offerings. Although the quality of airtime may not vary significantly across providers, an array of service packages typically is offered, none of which may

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[20]The Department of Justice and Federal Trade Commission Merger Guidelines of April 2, 1992 (p. 40) state that incentives to cheat on collusive agreements are greater the larger the proportional increase in sales from cheating and the smaller the base of sales prior to cheating.

[21]From Press Release, "Shosteck Releases Cellular Market Quarterly Review — Shows Cellular Sales and Subscriber Counts for Each Major Market," Silver Spring, Maryland, May 25, 1992, p. 3.

be directly comparable between competing providers.[22] The lack of an obvious basis for comparing service prices increases the cost of monitoring and punishing deviations from any collusive agreement in the short term.[23] With the introduction of Personal Communications Services (PCS), product heterogeneity will increase, and the cost of monitoring a collusive agreement will increase because price changes that reflect differences in service quality will be difficult to distinguish from price changes that undercut a tacit agreement.

The feature of the cellular industry that is most likely to raise competitive concerns among economists is the existence of a government-mandated barrier to further entry. The threat of entry in response to a profit opportunity should incumbents set artificially high prices often may have a dampening effect on the prices that are observed.[24] Ease of entry is a powerful competitive force[25] that cellular providers have not had to confront. However, with the advent of PCS, together with the introduction of a number of new service providers, cellular operators may be subject to additional competitive discipline.

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[22]The quality of airtime will vary from time to time, however, if cellular providers fail to anticipate the growth in subscribers, leading to increased traffic congestion.

[23]K.W. Clarkson, and R.L. Miller, Industrial Organization: Theory, Evidence, and Public Policy (New York, NY: McGraw-Hill Book Company, 1982), pp. 335-336.

[24]F. Modigliani, "New Developments on the Oligopoly Front," Journal of Political Economy 66 (1958), pp. 215-232.

[25]Posner, op. cit., p. 49.

The nature of transactions in cellular services tends to favor the stability of an industry agreement not to compete, although industry practices indicate that a "repeat-purchase" aspect of the cellular subscriber may dominate. In effect, cellular providers compete for a particular customer each month, since the cost of switching to the alternate supplier is minimal.[26] Frequent and small transactions diminish the gains from deviating from a collusive agreement and provide ample opportunity for retaliation against suppliers that do so.[27] However, the incentives offered consumers for initial subscriptions and the commissions paid to agents, which are determined by the expected lifetime of a subscription, represent an investment on the part of cellular providers. These investments signify that cellular providers expect an ongoing relationship with most customers.[28] To the extent subscribers represent a long-term stream of future monthly revenues, cellular service providers have an incentive to compete aggressively for new customers.[29]

The role of capacity in cellular services also has an ambiguous impact on the likelihood of sustained collusive behavior.

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[26]The activation fee typically is waived when a subscriber switches to the other provider. The phone must be brought in for reprogramming, however.

[27]Stigler, op. cit., pp. 47 and 51.

[28]On average, 15 percent of a cellular carrier's subscribers switch to the other provider during the course of a year, an observation made by Thomas E. Wheeler, the President of the CTIA, in a speech on October 21, 1992, entitled "The Wireless Century," p. 4.

[29]Stigler, op. cit., p. 51.

The capacity to serve subscribers increases in "lumpy" increments due to the nature of the technology. After the addition of new capacity, providers can serve new subscribers at low marginal cost. This scenario creates some pressure to undercut noncompetitive prices. On the other hand, economists recognize that idle capacity held by a price leader may serve to enforce collusive agreements.[30] The enforcement mechanism is the threat that the firm with significant excess capacity can flood the market with product to punish firms that undercut the noncompetitive price. However, economists tend to view excess capacity as a more important factor in industries experiencing cyclical or permanent downturns, a condition inapplicable to the past or foreseeable future of the cellular industry.

Economists recognize that an assessment of the degree of market competition must look beyond the number and size distribution of firms to factors that impede or foster collusive behavior. Clearly, there are characteristics of the cellular industry discouraging collusion and factors facilitating its practice. These characteristics by themselves are too complex to predict the competitive outcome. However, the observed performance in the cellular industry, most notably the rapid growth of the subscriber base and the steady decline in service prices, is consistent with competitive behavior.

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[30] Department of Justice and Federal Trade Commission Merger Guidelines, April 2, 1992, p. 40, footnote 19.

Cellular Telecommunications Industry Association

Semi-Annual Report on State Regulation

July 1993 Edition

JURISDICTION BY REGULATORY CATEGORY[1]

NOT REGULATED	PARTIALLY REGULATED	REGULATED
Alabama	Arizona	Alaska
Colorado	Arkansas	California
Delaware	Connecticut	Hawaii
District of Columbia	Illinois	Louisiana
Florida	Kentucky	Massachusetts
Georgia	Mississippi	Nevada
Idaho	New Mexico	New York
Indiana	Ohio	Vermont
Iowa	South Carolina	West Virginia
Kansas	Tennessee	Puerto Rico
Maine	Utah	
Maryland	Virginia	(10 Jurisdictions)
Michigan	Wyoming	
Minnesota		
Missouri	(13 Jurisdictions)	
Montana		
Nebraska		
New Hampshire		
New Jersey		
North Carolina		
North Dakota		
Oklahoma		
Oregon		
Pennsylvania		
Rhode Island		
South Dakota		
Texas		
Washington		
Wisconsin		
(29 Jurisdictions)		

[1] In this survey, states are classified as either regulated, partially regulated or not regulated. The extent of regulation depends on each jurisdiction's cellular regulatory policy. A regulated jurisdiction requires a carrier to obtain a Certificate of Public Convenience and Necessity ("CPCN") and file tariffs for both the wholesale and retail level. A partially regulated jurisdiction typically means that a CPCN and a tariff filing are required at the wholesale level but not at the subscriber level. A jurisdiction that is not regulated does not require cellular carriers to obtain a CPCN or file tariffs of any kind.

State Regulation of Cellular Telephone Service

July 1993 Edition

Status Report

Jurisdiction and Regulatory Status	Comments
Alabama Not Regulated	
Alaska Regulated	CPCN and tariffs required. Carriers may construct and operate a system without PUC authority but cannot charge for service. Prior to charging for service, a carrier must file an application for a CPCN and for approval of a tariff. By statute, cellular carriers are rate regulated like all other utilities. Carriers can be exempted from this requirement, but must seek approval for the exemption from the state PUC.
Arizona Partially Regulated	On the wholesale level, CPCNs and tariffs are required. On the retail level, neither are required. Increasing wholesale rates requires a full rate proceeding.

JURISDICTION AND REGULATORY STATUS	COMMENTS
Arkansas Partially Regulated	CPCNs are required on both the wholesale and retail level. No tariffs are required. Rules and regulations related to cellular operations are under PSC jurisdiction including security deposits, disconnections, etc.
California Regulated	CPCNs and tariffs are required on both the wholesale and retail level. In a decision adopted in October 1992, the PUC added major new regulations for cellular, including: allowing resellers to interconnect their own switch with facilities-based carriers' MTSOs, requiring a 14.75% rate of return on retail costs, restricting cellular carriers from reselling in areas where they offer retail service, and requiring carriers to segregate the costs of wholesale and retail activities. A rehearing on the October decision has been granted and will be included in the PUC's Phase Four investigation.
Colorado Not Regulated	
Connecticut Partially Regulated	CPCNs and tariffs are required on the wholesale level but neither are required on the retail level.

Jurisdiction and Regulatory Status	Comments
Delaware Not Regulated	
District of Columbia Not Regulated	
Florida Not Regulated	
Georgia Not Regulated	
Hawaii Regulated	CPCNs and tariffs are required on both the wholesale and retail levels.
Idaho Not Regulated	
Illinois Partially Regulated	CPCNs and annual reports are required. Tariffs are required in MSAs and RSAs only when there is a single system in operation.
Indiana Not Regulated	A CPCN is required but is known as a "Certificate of Territorial Authority." No tariffs are required.
Iowa Not Regulated	
Kansas Not Regulated	

Jurisdiction and Regulatory Status	Comments
Kentucky Partially Regulated	CPCNs and tariffs are required on the wholesale level but not on the retail level. A CPCN must be filed with the PSC for each cell site. Currently, the PSC is investigating the regulation of cellular.
Louisiana Regulated	CPCNs and tariffs are required on both the wholesale and retail level.
Maine Not Regulated	
Maryland Not Regulated	
Massachusetts Regulated	CPCNs are required on both the wholesale and the retail level. Rates may fluctuate below an approved maximum.
Michigan Not Regulated	Cellular providers cannot unreasonably bundle or cross-subsidize their retail operations.
Minnesota Not Regulated	
Mississippi Partially Regulated	CPCNs and tariffs are required on the wholesale level. A CPCN is also required on the retail level but a retail tariff is required for record purposes only.

Jurisdiction and Regulatory Status	Comments
Missouri Not Regulated	
Montana Not Regulated	
Nebraska Not Regulated	
Nevada Regulated	CPCNs and tariffs are required on both the wholesale and retail level. Carriers are required to use NARUC's Uniform System of Accounts and Annual Report Form. Resellers are required to obtain a CPCN but are not required to file tariffs.
New Hampshire Not Regulated	
New Jersey Not Regulated	
New Mexico Partially Regulated	CPCNs and tariffs are required on the wholesale level only.
New York Regulated	CPCNs and tariffs are required on both the wholesale and retail level. Streamlined regulations allow price changes within pre-approved minimum and maximum tariff ranges on one day's notice.

JURISDICTION AND REGULATORY STATUS	COMMENTS
North Carolina Not Regulated	Based on legislation enacted in 1991, the state PUC deregulated cellular in early 1992. The decision to deregulate is under appeal by the state attorney general.
North Dakota Not Regulated	Carriers are required to obtain a certificate of registration before initiating service.
Ohio Partially Regulated	CPCNs and tariffs are required on the wholesale level only. Currently, the PUC is studying the regulation of cellular. Legislation to expedite the deregulation of cellular and paging is pending.
Oklahoma Not Regulated	
Oregon Not Regulated	
Pennsylvania Not Regulated	
Puerto Rico Regulated	CPCNs and tariffs are required on both the wholesale and retail level.
Rhode Island Not Regulated	
South Carolina Partially Regulated	CPCNs and tariffs required on the wholesale level only.

Jurisdiction and Regulatory Status	Comments
South Dakota Not Regulated	Operators must notify the PUC of their intention to operate at least thirty days in advance. An annual report is also required. CPCNs have been required since July 1, 1992 but are issued automatically.
Tennessee Partially Regulated	CPCNs and tariffs are required on the wholesale level only. They are required until or unless a second cellular carrier offers service in the same market or for six months after the issuance of an FCC construction permit to a second market carrier.
Texas Not Regulated	The PSC is conducting a study of telecommunications services.
Utah Partially Regulated	CPCNs and tariffs are required on both the wholesale and retail level until a second carrier offers service.
Vermont Regulated	CPCNs and tariffs are required on both the wholesale and retail level.
Virginia Partially Regulated	CPCNs and tariffs are required on the wholesale level only.
Washington Not Regulated	

JURISDICTION AND REGULATORY STATUS	COMMENTS
West Virginia Regulated	CPCNs and tariffs are required on both the wholesale and retail level.
Wisconsin Not Regulated	Cellular is deregulated statewide. At 10% market penetration statewide, cellular is regulated as an "Alternative Telecommunications Utility."
Wyoming Partially Regulated	CPCNs and tariffs required on the wholesale level only.